

Factors that Influence Erosion

- Soil Properties
- Precipitation
- Vegetation Cover
- Topography

THE REMAINS OF DENNY HILL

OTFRA904 SEATTLE 620

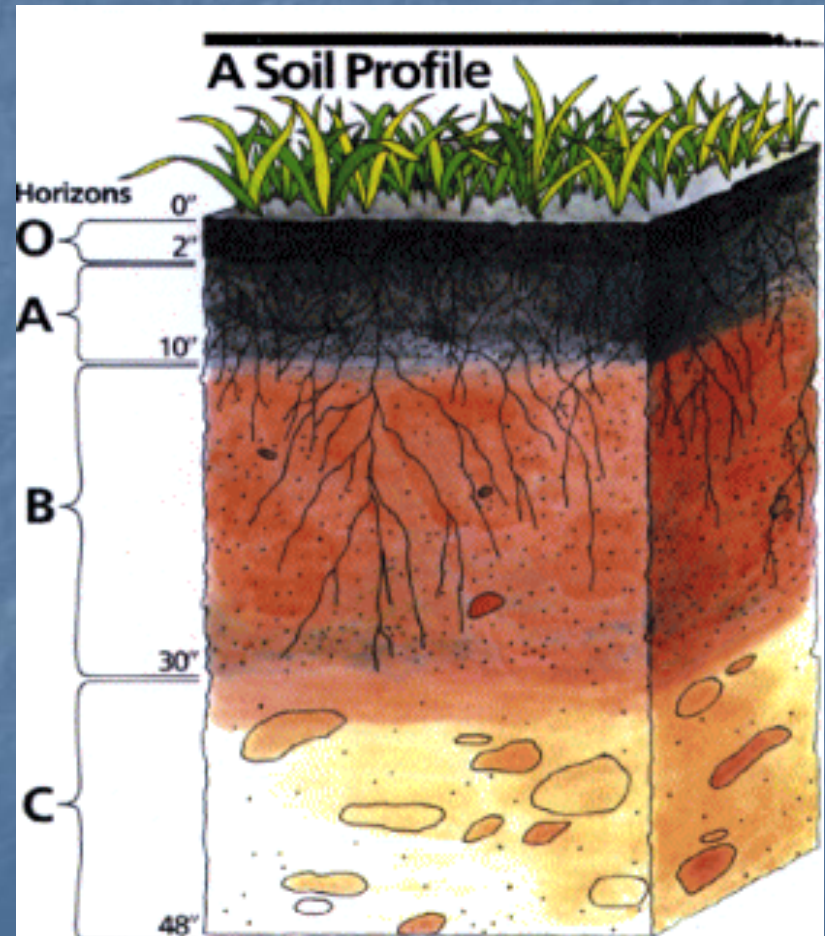
Soil Properties

Texture

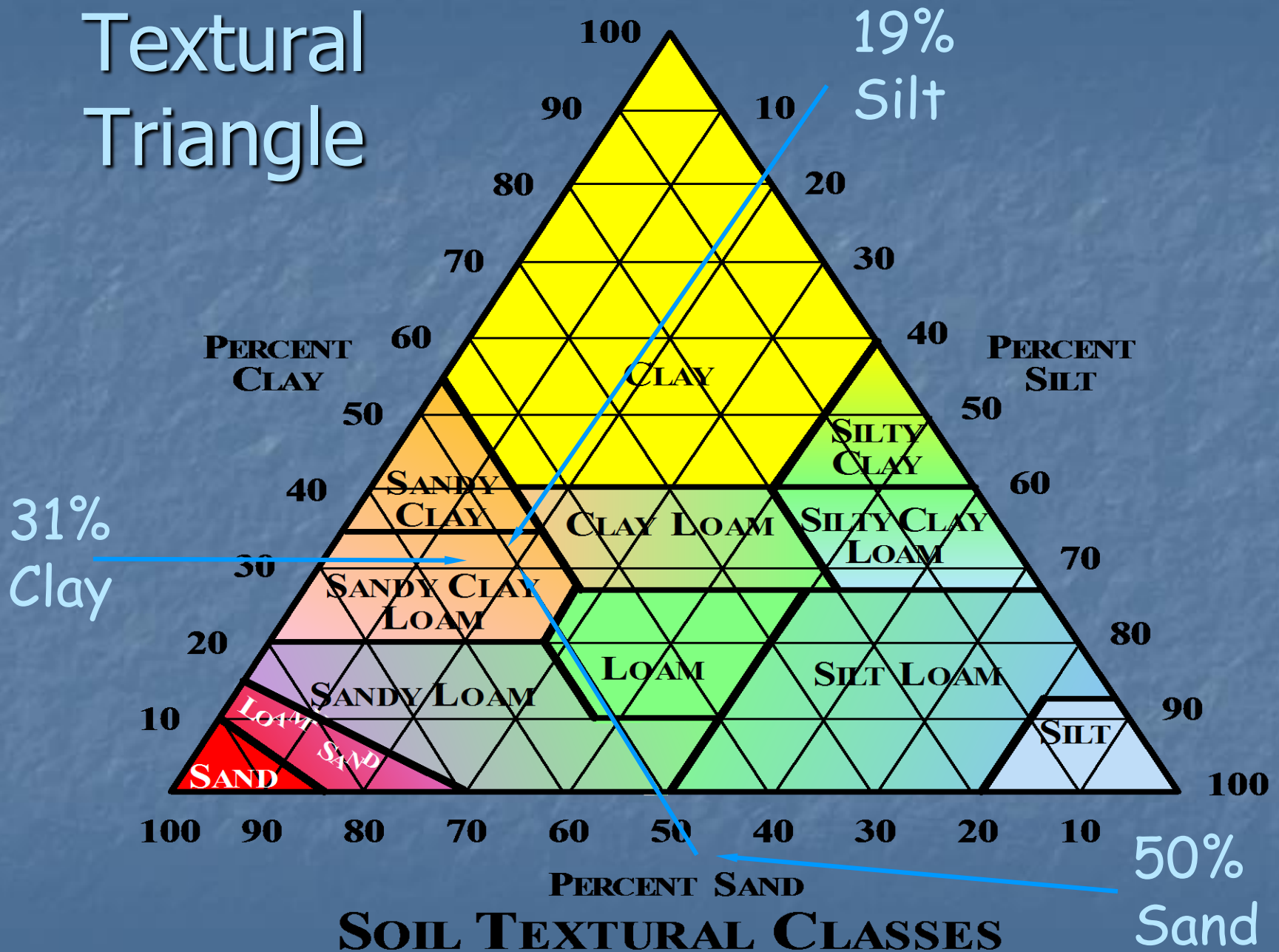
Depth of Solum

Structure

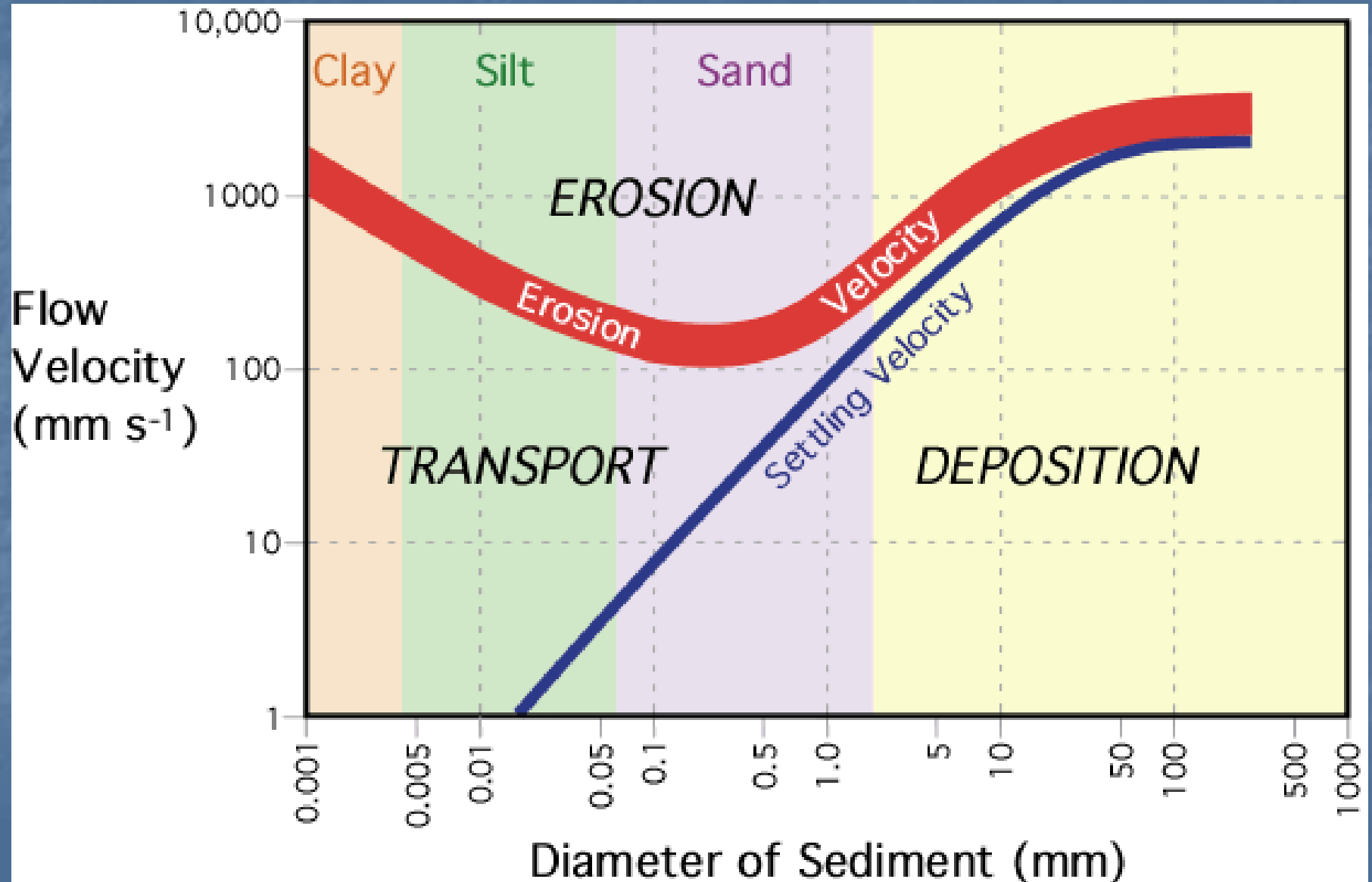
Organic Content



Textural Triangle

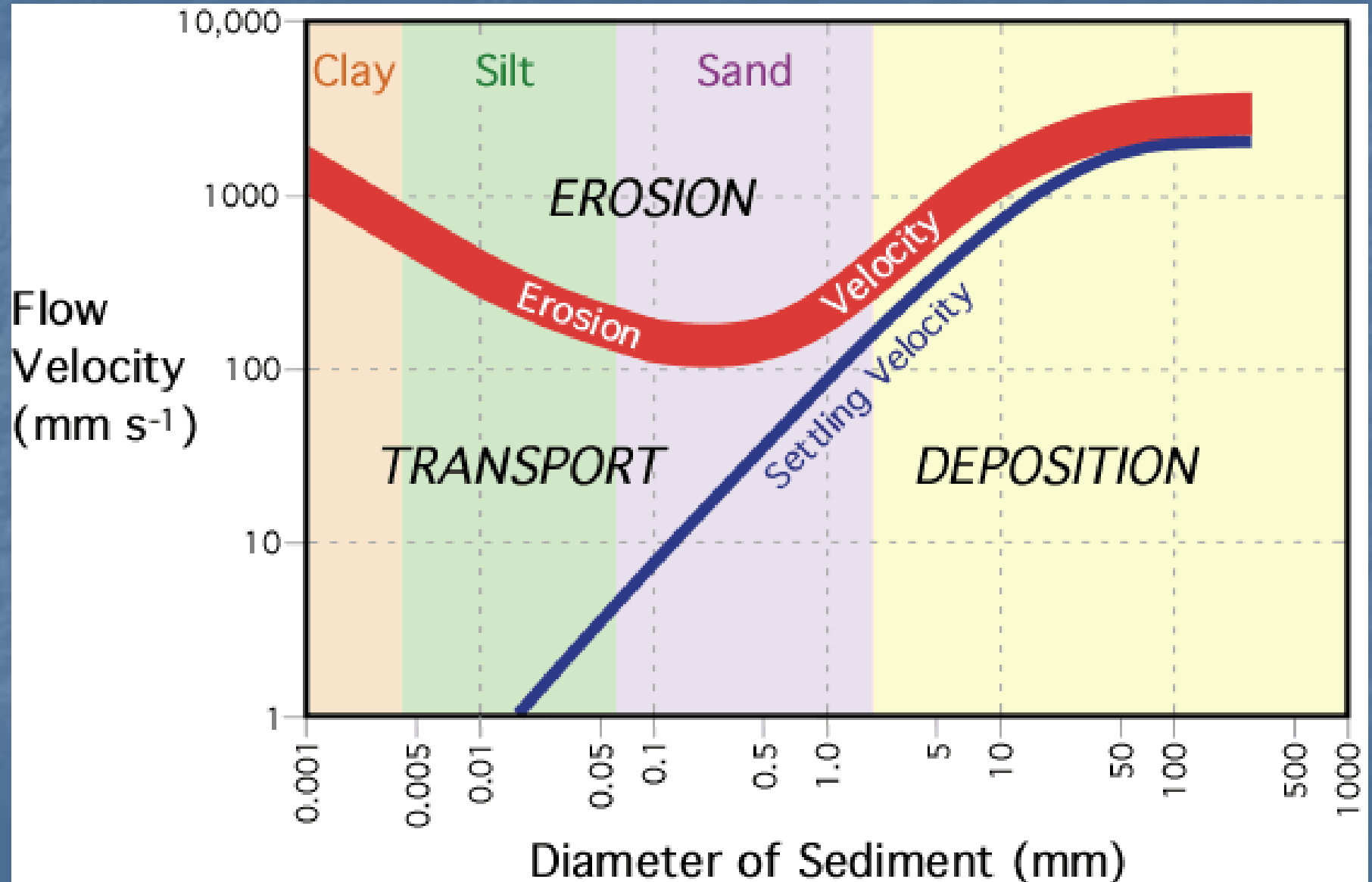


Hjulstrom Diagram



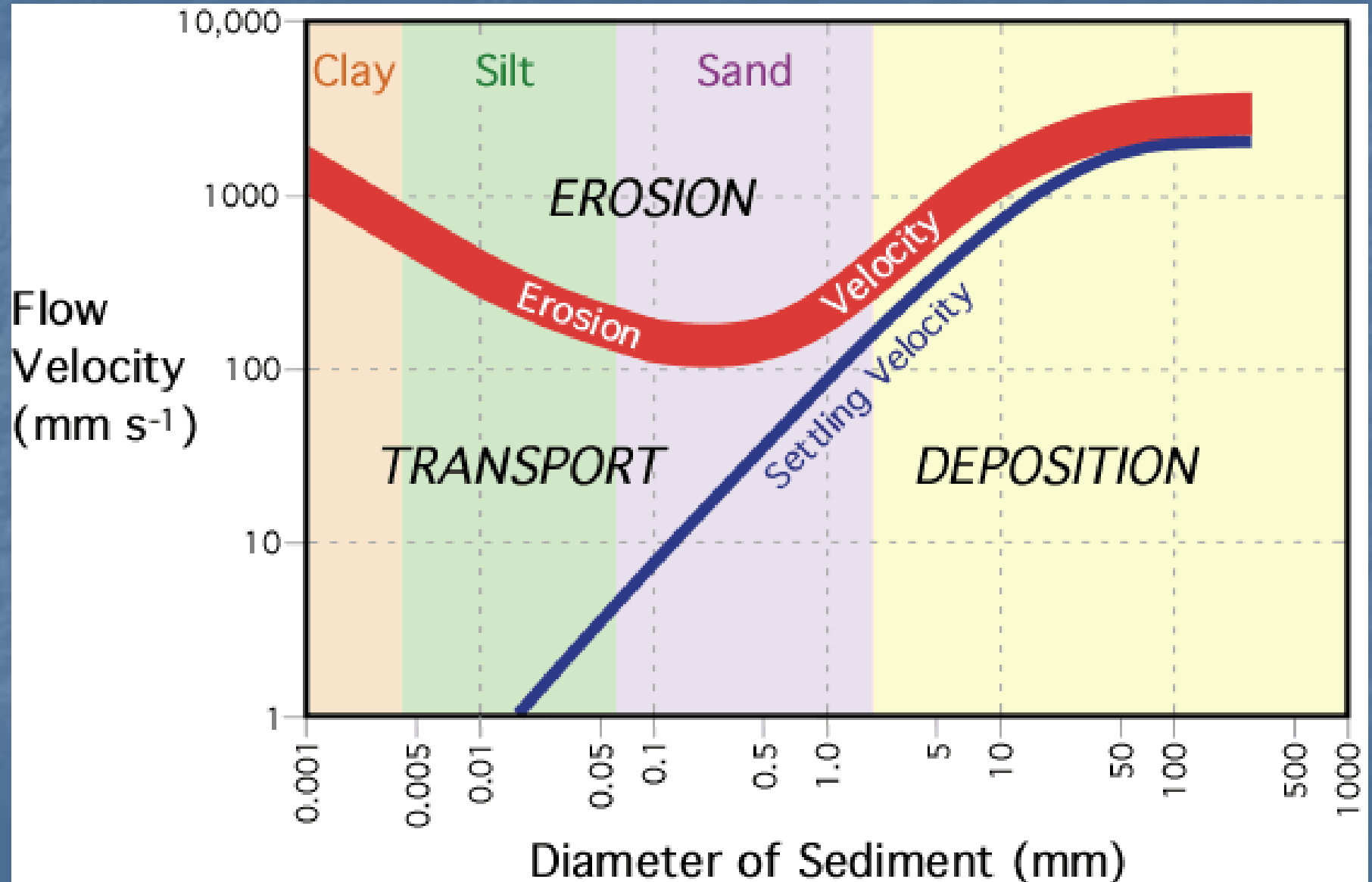


Hjulstrom Diagram



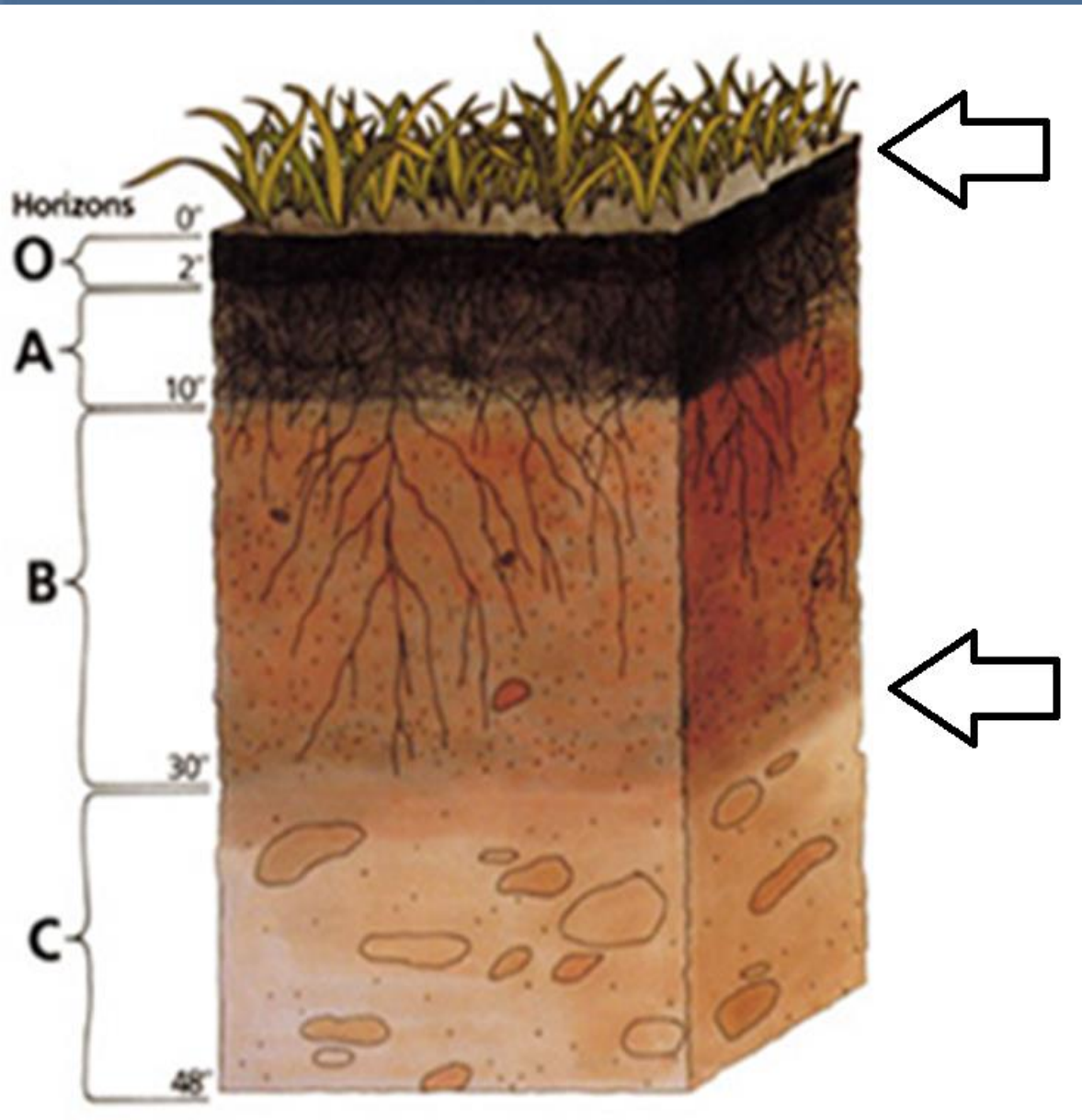


Hjulstrom Diagram





Solum Thickness



The upper part of the soil is called the Solum (A+B horizons). In undisturbed soils these upper horizons are highly permeable due to well developed soil structure.

Soil Structure





Break for Origami Demo

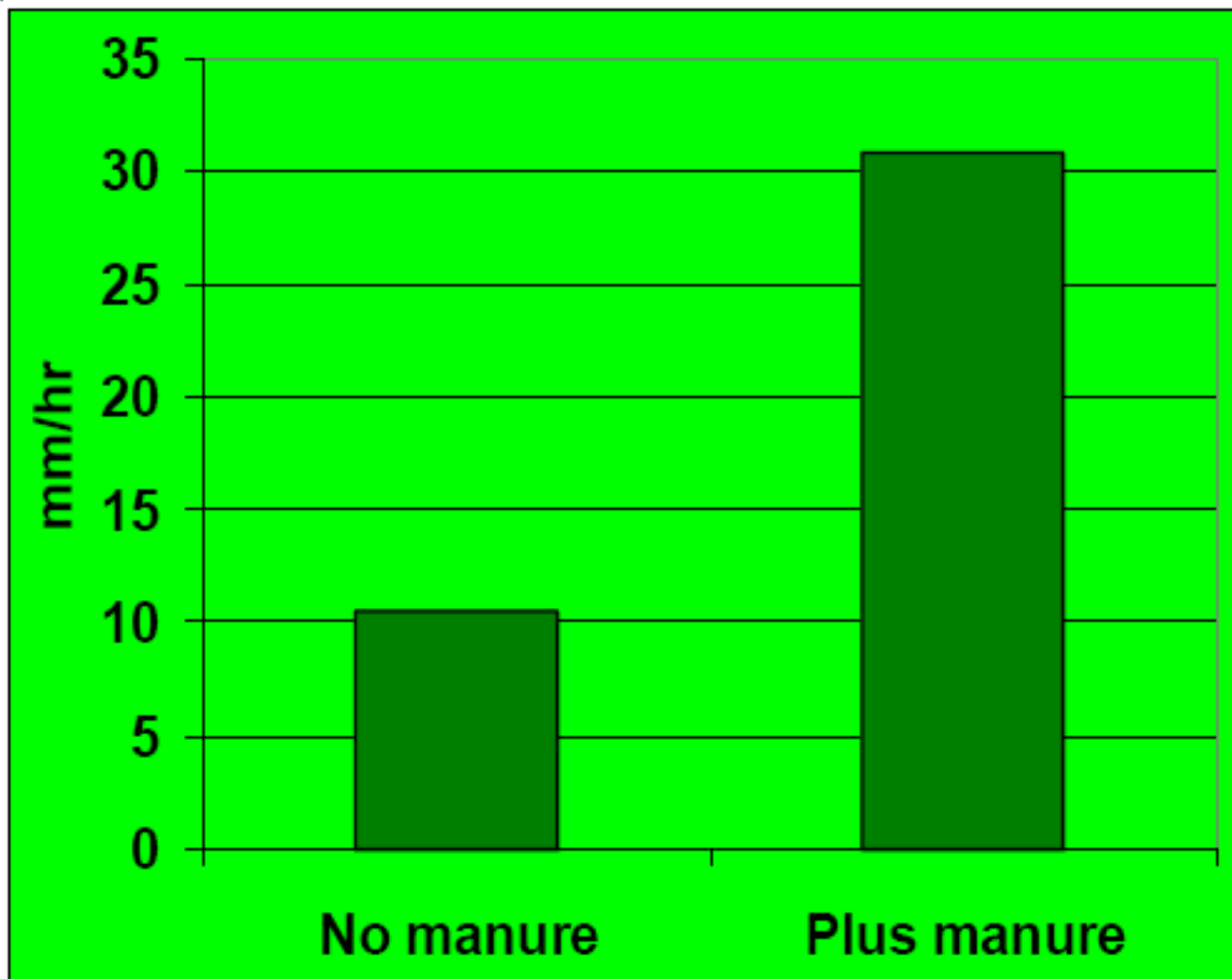


Fig 2 *Effect of chicken manure (8 t/ha, incorporated) on soil infiltration rate in an annual ryegrass pasture (measured 6 months after application)*



By the way, in addition to increasing soil permeability and , decreasing erosivity, organic matter in soil is an important global carbon sink



On a construction site soil structure is often destroyed by compaction, either intentionally...



or as a consequence of other construction activities

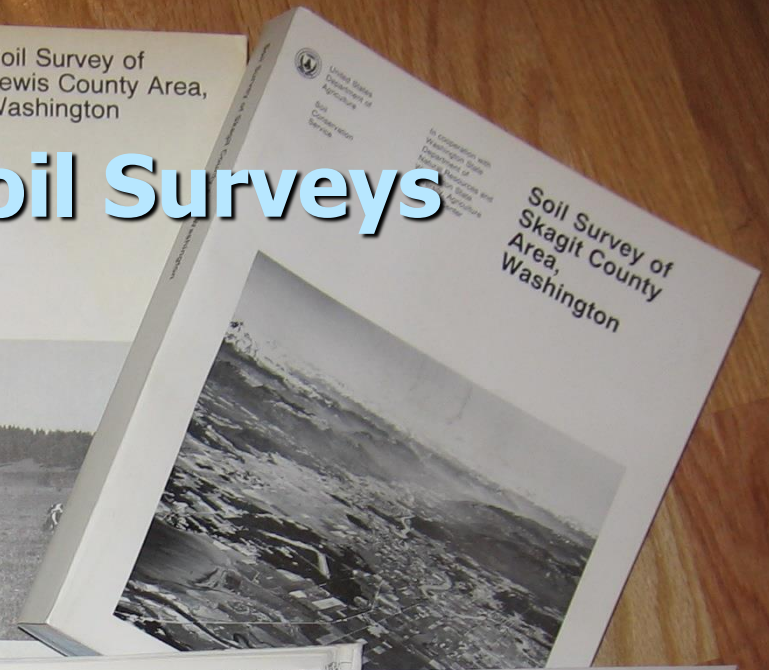
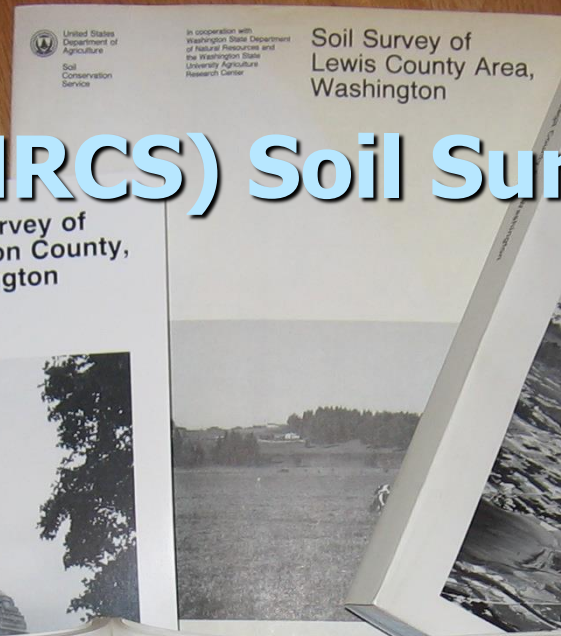
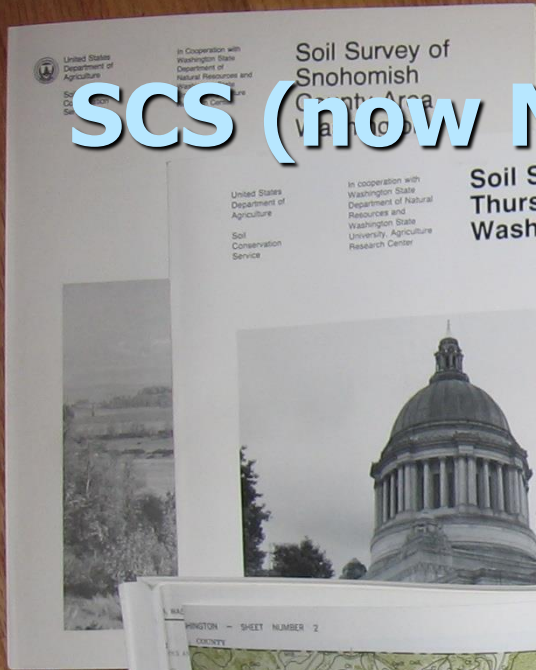


Or removed completely during mass grading



Sources of Information on Site Specific Soil Properties

SCS (now NRCS) Soil Surveys



NRCS Web Soil Survey

Address <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>

USDA United States Department of Agriculture
Natural Resources Conservation Service

Web Soil Survey

Contact Us | Download Soils Data | Archived Soil Surveys | Preferences | Logout | Help

Area of Interest (AOI) | Soil Map | Soil Data Explorer | Shopping Cart

Quick Navigation

Navigate By...

- Address
- State and County
- Soil Survey Area
- Latitude and Longitude
- PLSS (Section, Township, Range)
- Bureau of Land Management
- Department of Defense
- Forest Service
- National Park Service
- Hydrologic Unit

Area of Interest Interactive Map

Legend

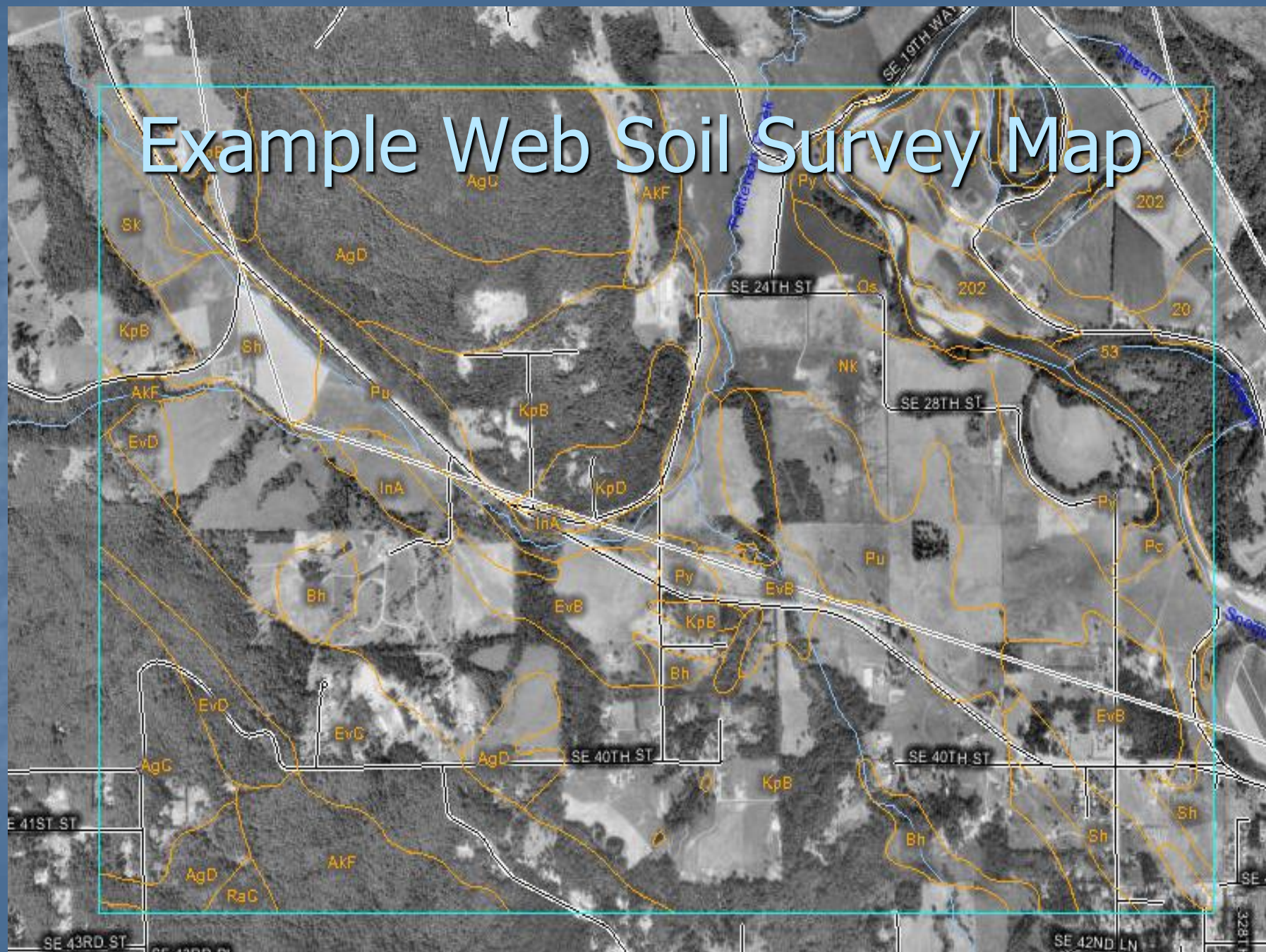
View Extent: Continental U.S.

Scale: (not to scale)



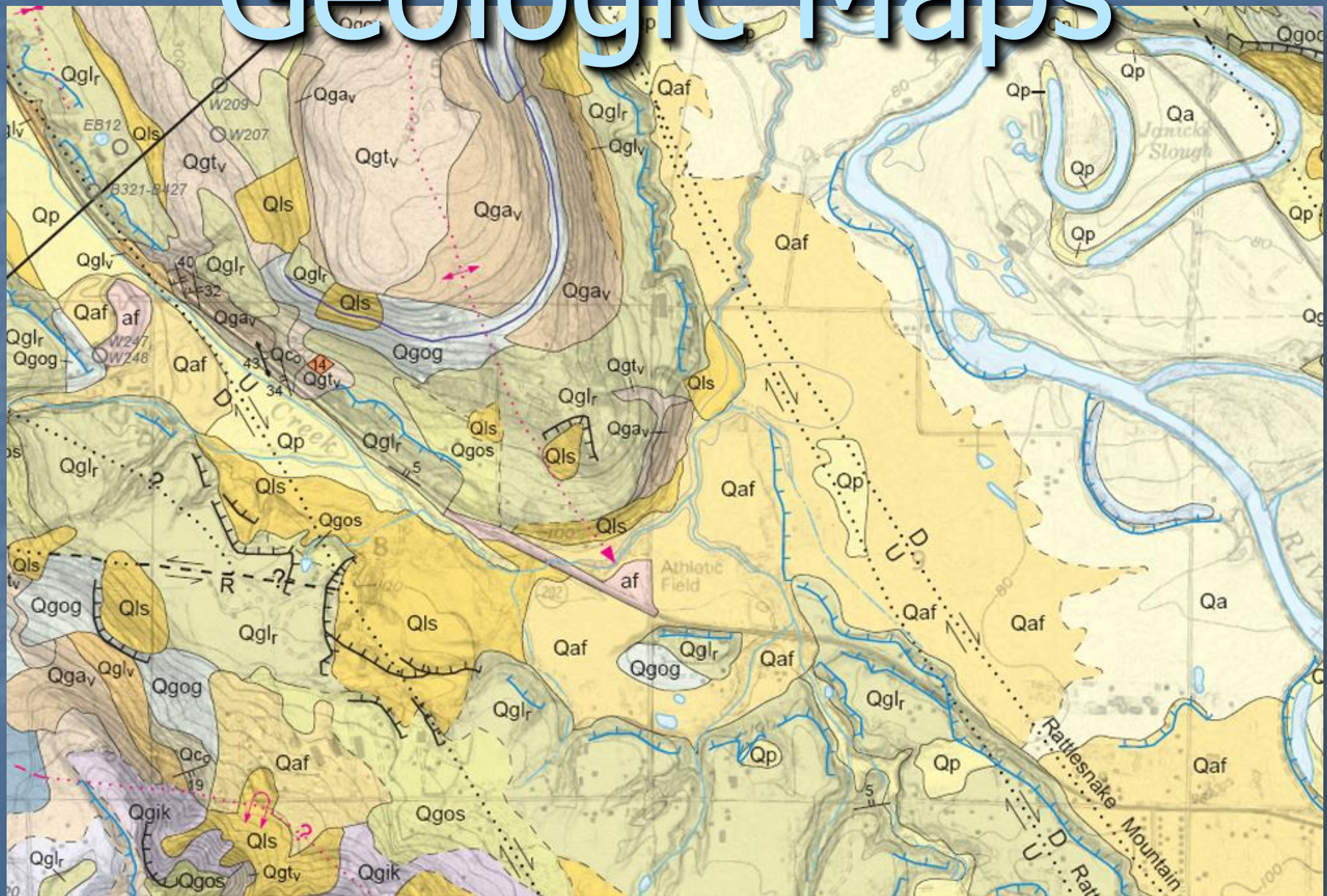
0 785.1 mi

Example Web Soil Survey Map





Geologic Maps




Examples of Erosion Issues for Some Common Local Soil Series

Alderwood soil

Developed on glacial till. Coarse texture and glacial consolidation render it relatively resistant to erosion, but the presence of a shallow impervious layer at depth often leads to erosion problems related to standing water and poor drainage.

Indanola Soils



Developed on sandy glacial advance outwash. These soils are readily eroded by flowing water.

Kitsap Soils



Kitsap soils are developed on fine-grained proglacial lake beds. They have poor drainage, are difficult to work when wet, create highly turbid runoff when disturbed and are often associated with areas of unstable slopes

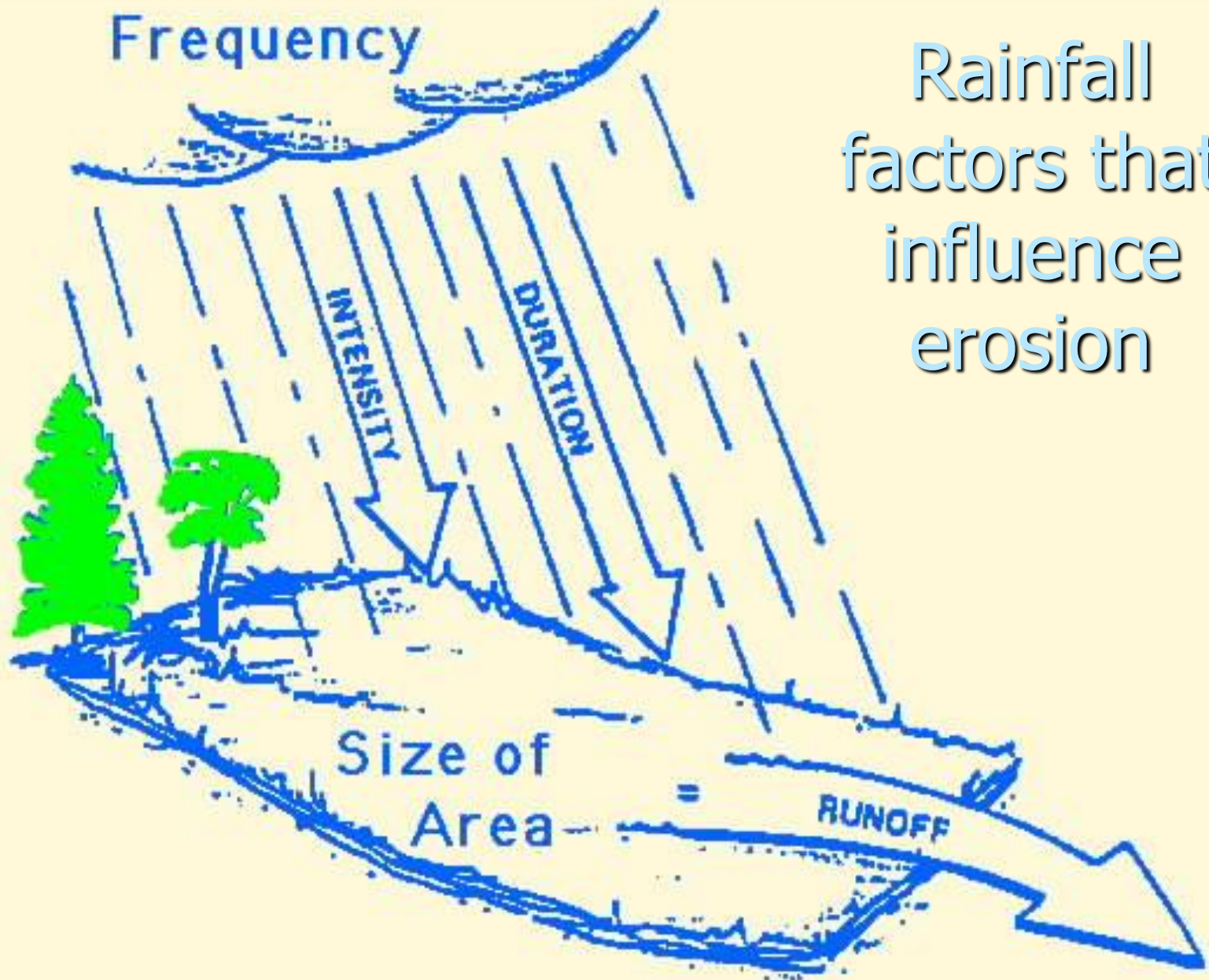
A good CESCL knows their dirt!





Precipitation

Rainfall factors that influence erosion



WELCOME TO

Washington

THE EVERGREEN STATE

Seattle

H: 58° L: 51°

54°

SATURDAY

58° 51°

SUNDAY

55° 52°

MONDAY

57° 53°

TUESDAY

55° 50°

WEDNESDAY

51° 45°

THURSDAY

50° 45°



Updated 9/29/07 7:34 PM



We've
seen
Seattle
Forecasts

We've
Heard
the
Seattle
Jokes



A painterly illustration of a rainy street scene. In the center, a person wearing a bright red hooded coat and dark pants stands with their back to the viewer on a sidewalk. To the left, a teal car is parked on the street. In the background, there are several houses with steep roofs and a tall wooden utility pole. The sky is grey and filled with falling rain, which is depicted as numerous white streaks. The wet pavement reflects the light from the rain and the distant car. The overall style is soft and atmospheric, with visible brushstrokes.

So how wet are we?

A map of the United States is shown in the background, with various states colored in different shades of yellow, orange, blue, and green. Overlaid on the map is the text "What is the wettest state in the US?" in a large, white, rounded, sans-serif font. The text is arranged in three lines: "What is the" on the first line, "wettest state" on the second line, and "in the US?" on the third line. The text is centered horizontally and vertically across the map.



#1: Hawaii:
63.7 in/yr

#2 Louisiana
60.1 in/yr



What is the driest
State?

A photograph of the Nevada #50 nuclear test. A large, bright, orange-yellow fireball is rising from the ground, with a thick column of smoke and debris trailing behind it. The background shows a vast, arid desert landscape with rolling hills under a clear sky.

Nevada #50

9.5 inches/year

Where is Washington
State?

Washington

#29

38.4 Inches/year

Rainfall Intensity

States with the
Highest
50 year, 30 minute
Intensity?

Maui,
Hawaii,
5.5 inches



Louisiana
& Florida
3.6 Inches

States with the
Lowest
50 year, 30 minute
Intensity?

Washington

along with OR, ID, CA, NV, MT

50 year, 30 minute
Intensity?

0.6 Inches

Seattle Annual Precipitation Comparison *

★ Seattle, WA
Normal Annual
Precip: 37.49"

* NCDC 1981-2010
8526 Stations

Drier Than Seattle

Wetter Than Seattle

Comparison

- Wetter
- Drier

Drier
Than
Seattle

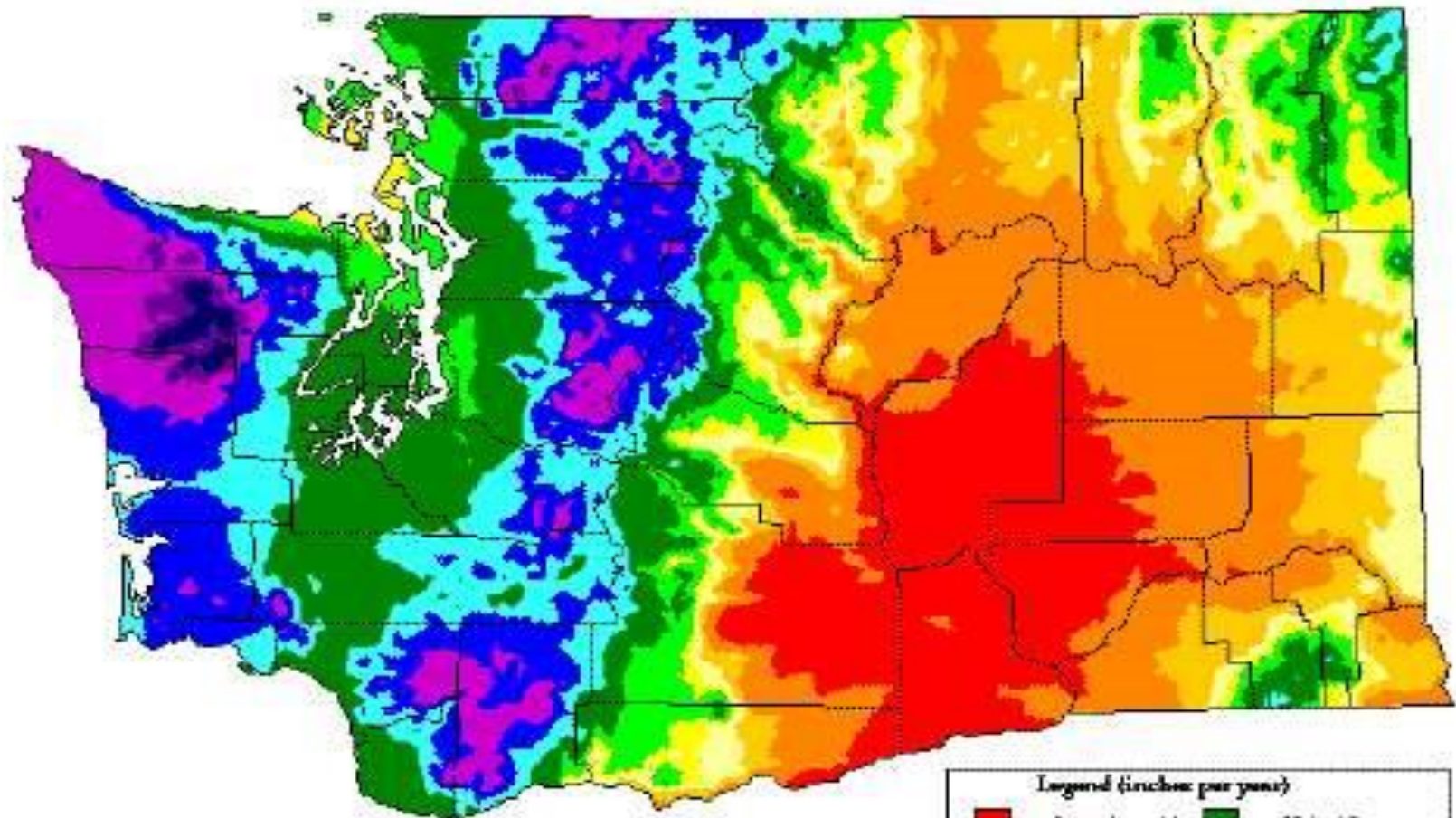
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Climate



Average Annual Precipitation

Washington

Period: 1961-1990 Units: inches

Legend (inches per year)



www.wrcc.dri.edu



Western Regional Climate Center

Historical Climate Information

Western U.S. Historical Summaries; Precipitation Maps; Station Inventories; Wind and Evaporation Data; Coastal Water Table; State Narratives; Station Descriptions; Anomalies.

WRCC Projects

El Nino & La Nina; CEMP; WET; BLM RAWs; Yucca Mtn; Current Weather Plots; NSOE; Snotel; California Climate Data Archive; Photo Gallery; Webcam.

Educational and Travel Pages

Terms; More about Weather and Climate - for teachers and kids! Climate for resorts and Nat'l parks around the West.

Current Observations, Forecasts and Monitoring

Nat'l Weather Service Current and Past 24-hour Reports; Snotel; Climate Prediction Center Outlooks; Satellite and Radar Imagery; SPI; Anomalies; Divisional Climate Plots;

More Climate Information

Solar Radiation; Sunrise/Sunset Information (USNO); WGA data and information; Nat'l Climatic Data Center; Climate Prediction Center; CEFA; Nat'l Drought Mitigation Center.

About the WRCC

Staff; Funding; Overview of WRCC; DRI Home Page; INTERNAL.

WRCC Supports a Three-Partner National Climate Services Program - the Partners Include:
National Climatic Data Center (NCDC), Regional Climate Centers (RCC's), and State Climate Offices.

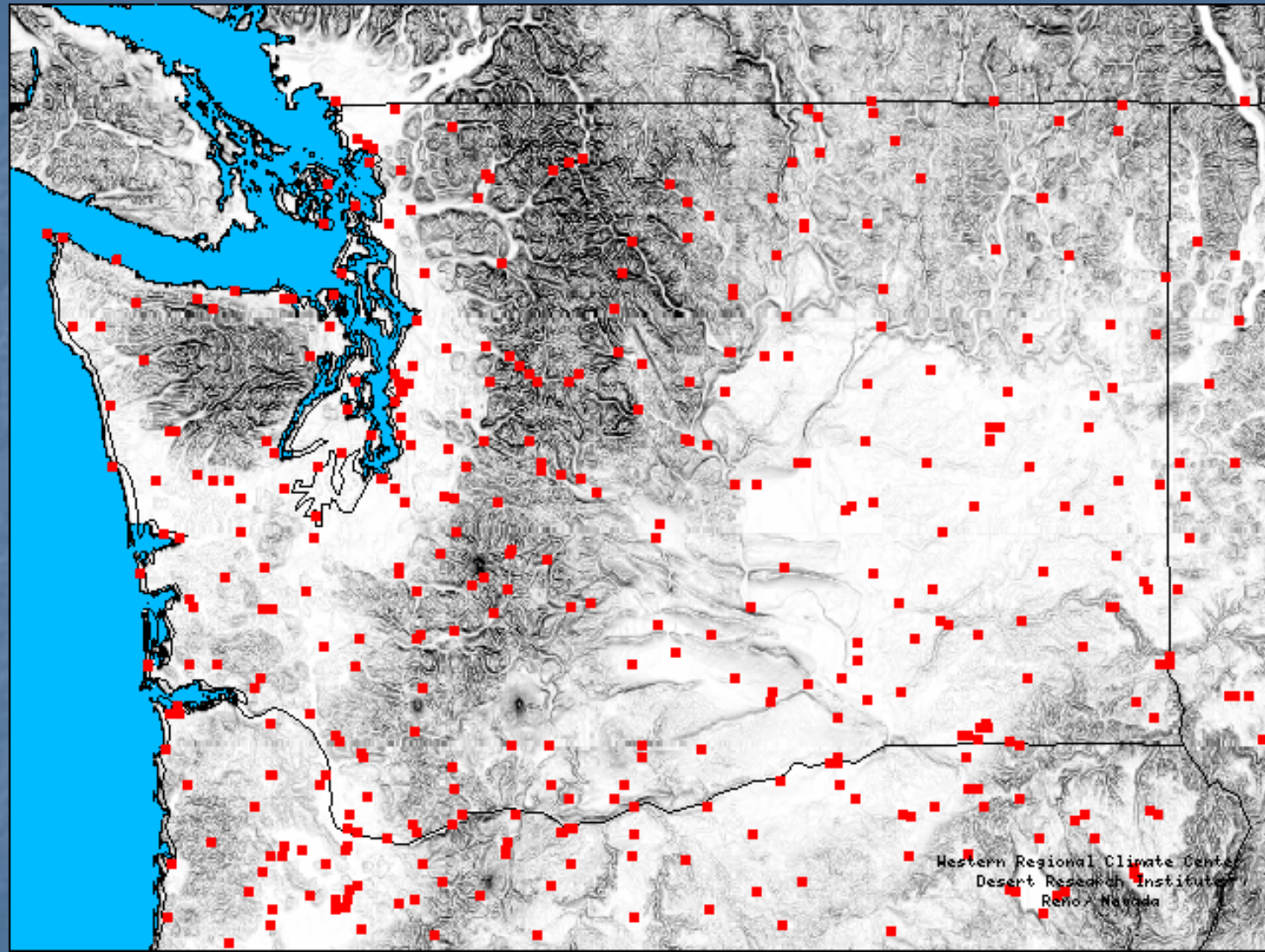


Address:
WRCC
2215 Raggio Parkway
Reno, NV 89512
(775) 674-7010 - phone
(775) 674-7016 - fax

wrcc@dri.edu



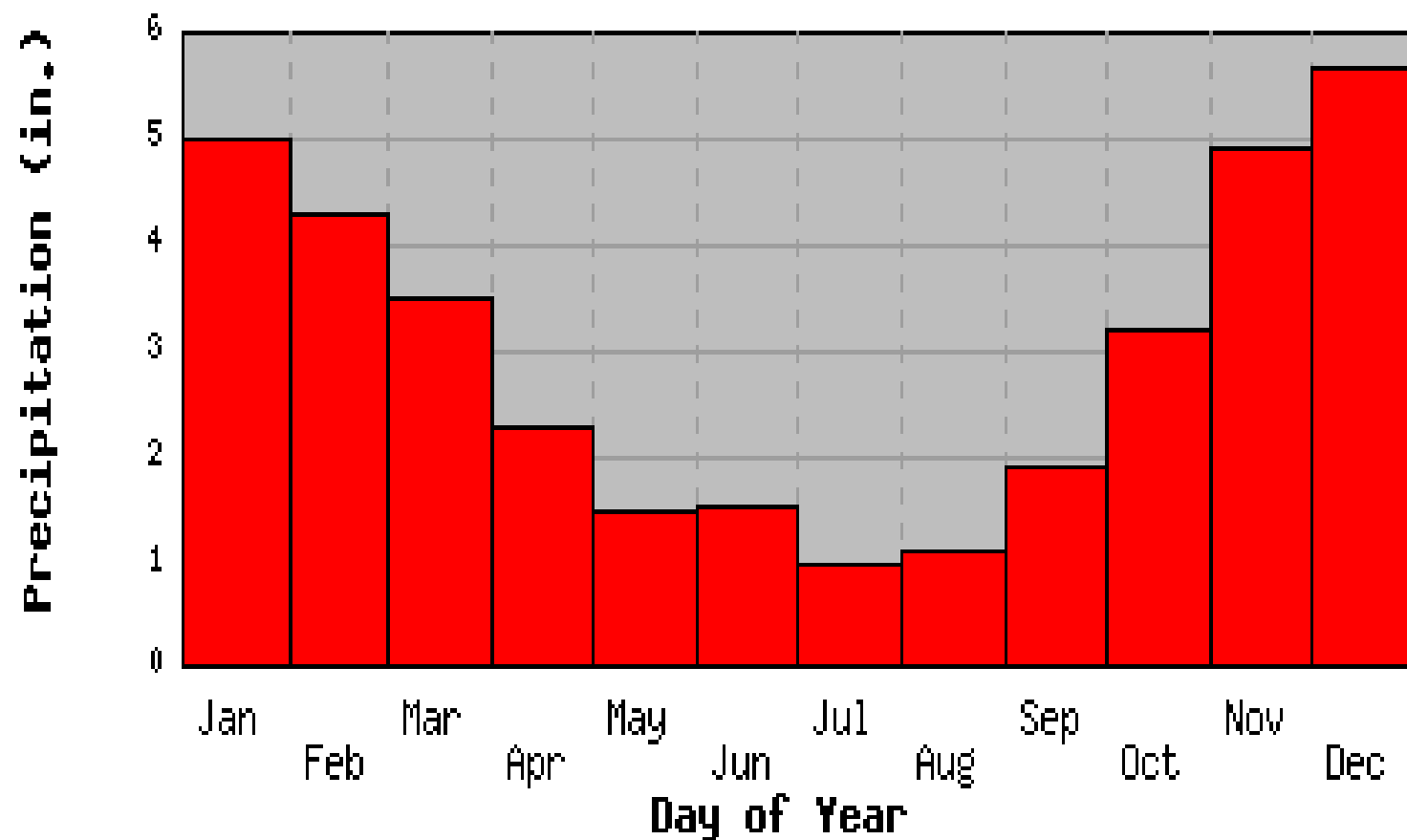
Rainfall Data on the Internet



<http://www.wrcc.dri.edu/summary/Climsmwa.html>

SEATTLE UNIV OF WASHING, WASHINGTON (457478)

Period of Record : 6/ 2/1948 to 7/31/1983



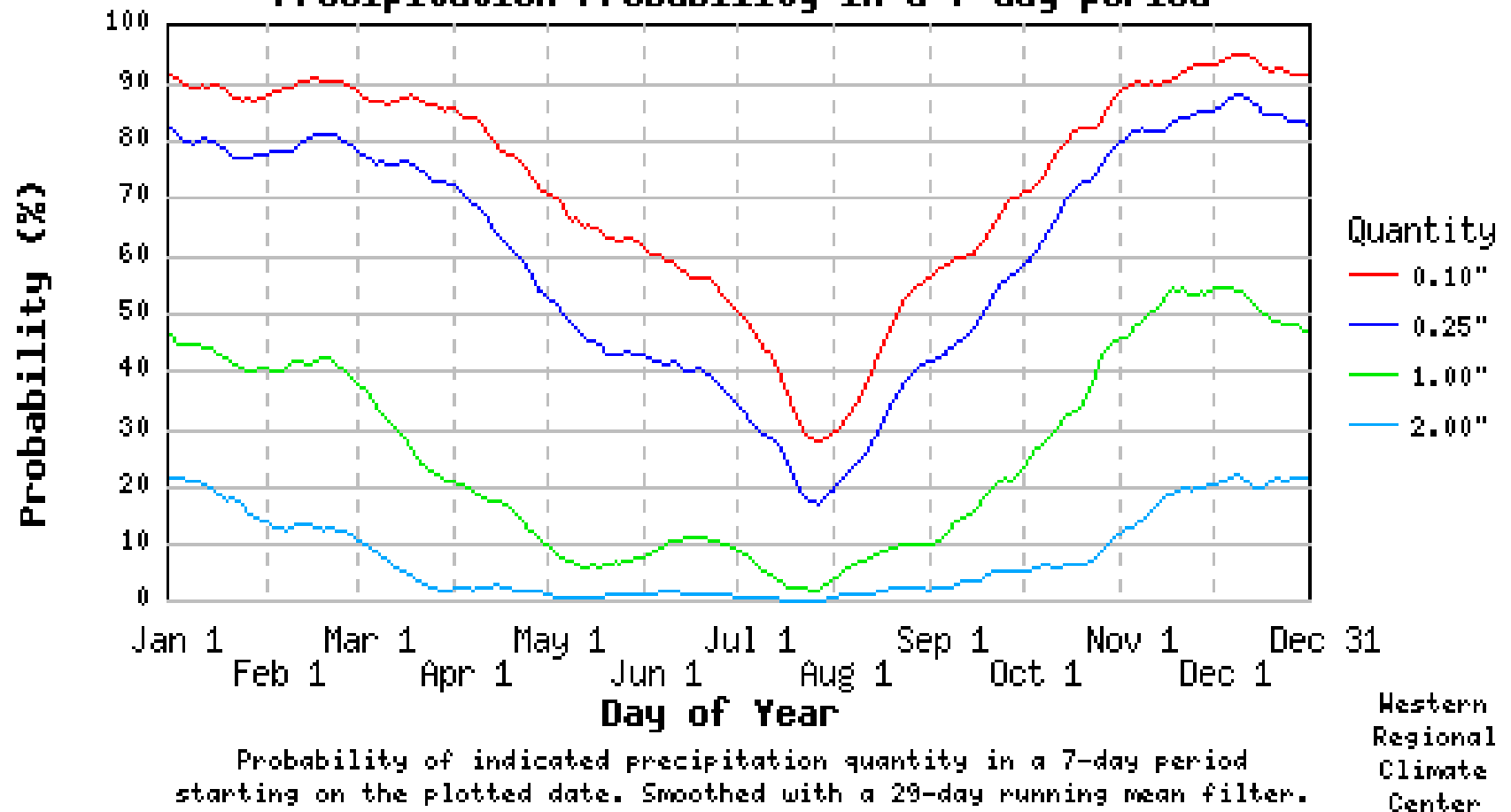
Average Total Monthly Precipitation

Western
Regional
Climate
Center

SEATTLE UNIV OF WASHING, WASHINGTON (457478)

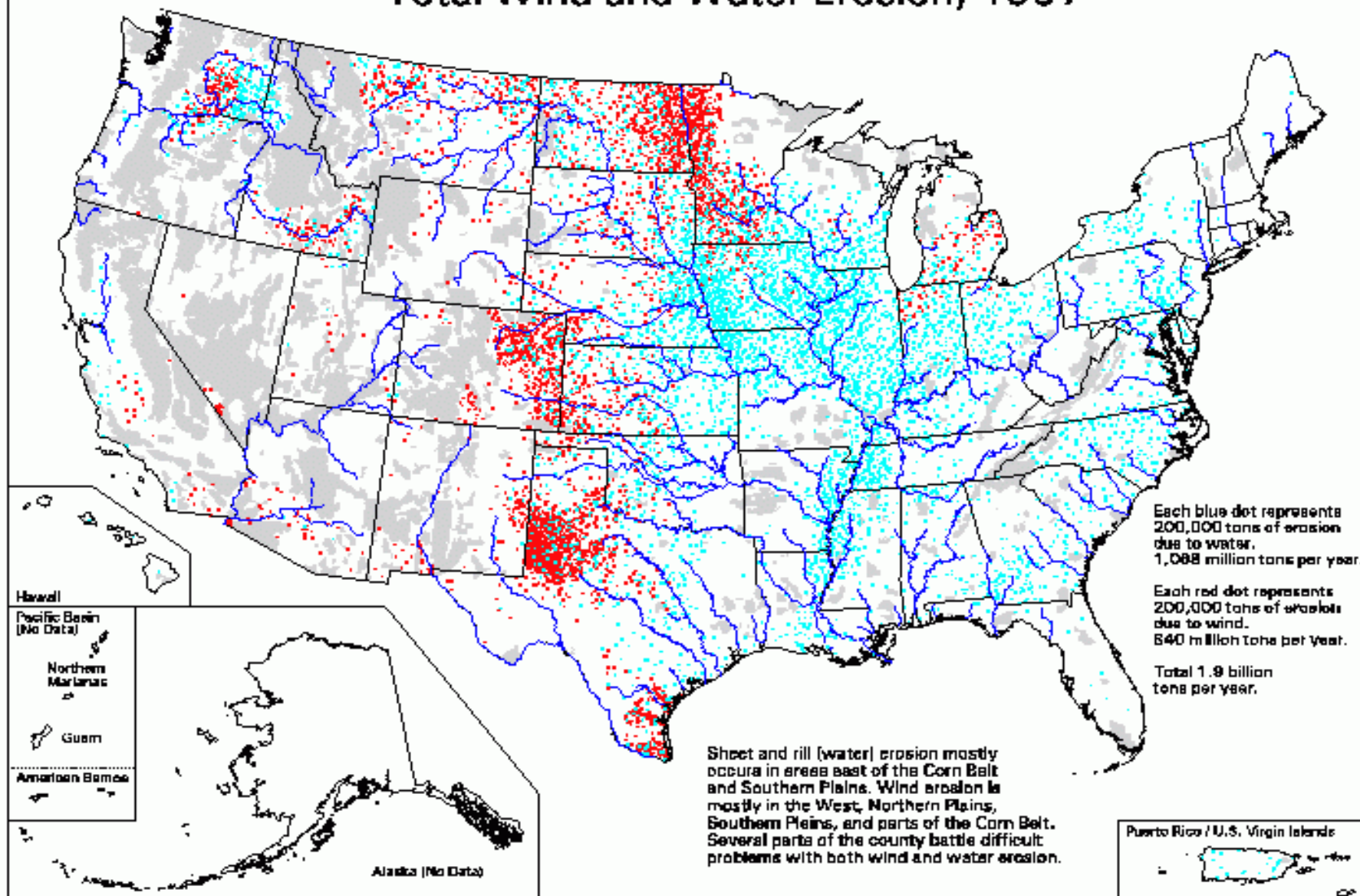
Period : 6/ 2/1948 to 7/31/1983

Precipitation Probability in a 7-day period



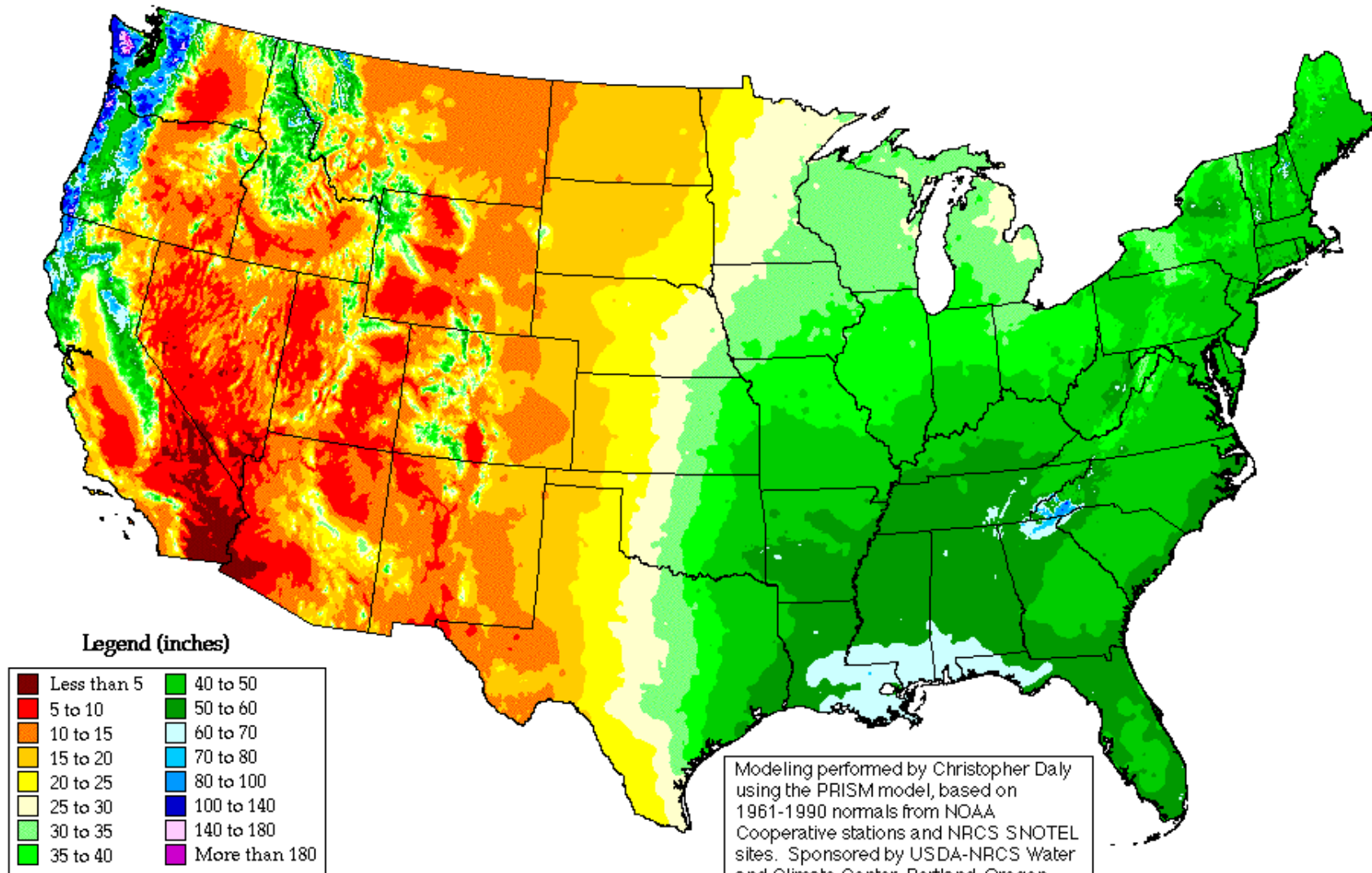
45% probability of 1/4 inch in June

Total Wind and Water Erosion, 1997



Annual Average Precipitation

United States of America

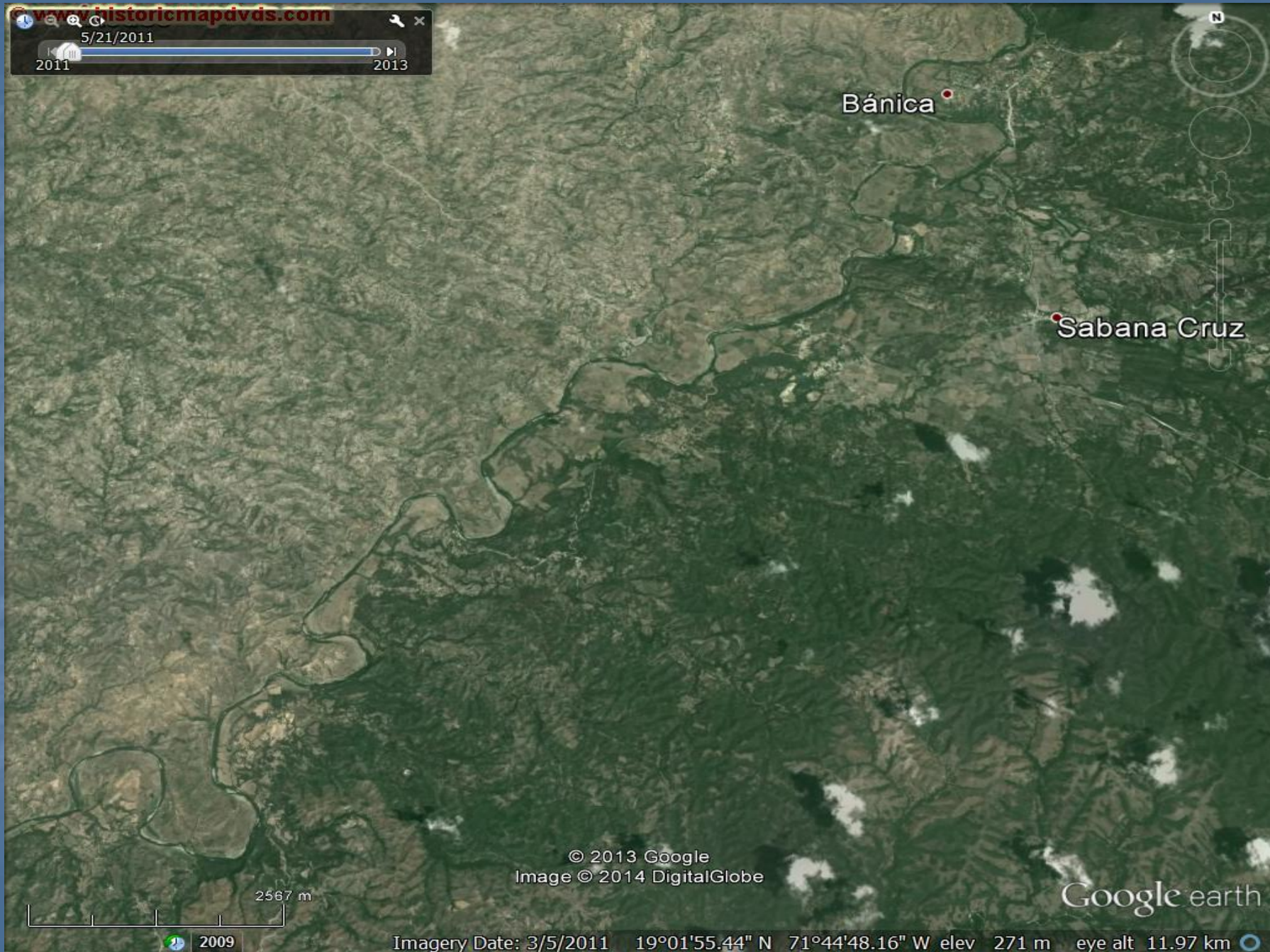


Period: 1961-1990

Modeling performed by Christopher Daly using the PRISM model, based on 1961-1990 normals from NOAA Cooperative stations and NRCS SNOTEL sites. Sponsored by USDA-NRCS Water and Climate Center, Portland, Oregon.

Oregon Climate Service
George Taylor, State Climatologist
(541) 737-5705





© 2013 Google
Image © 2014 DigitalGlobe

Google earth



Imagery Date: 3/5/2011 19°01'55.44" N 71°44'48.16" W elev 271 m eye alt 11.97 km







Rivière Grise in Port au Prince



How do Plants stabilize the Soil?

- ♦ **Increase Surface Roughness**
- ♦ **Absorb Rainsplash Energy**
- ♦ **Provide Soil Reinforcement**
- ♦ **Promote Good Soil Structure**
- ♦ **Reduce Runoff Volume**
- ♦ **Trap Sediment**



Interception and energy absorption



Photo by USDA - NRCS





So, What's the first thing we do at a construction site??



Photo courtesy Clark County Watershed Stewards

Topography

A topographic map showing contour lines, a creek, and an athletic field. The map is overlaid with text and a diagram. The text lists elements of topography: Slope Steepness, Slope Length, Slope curvature, and Aspect. A diagram in the bottom left shows a circular compass rose with a red arrow pointing towards the top left, indicating a specific direction or aspect.

Elements of Topography:

Slope Steepness

Slope Length

Slope curvature

Aspect

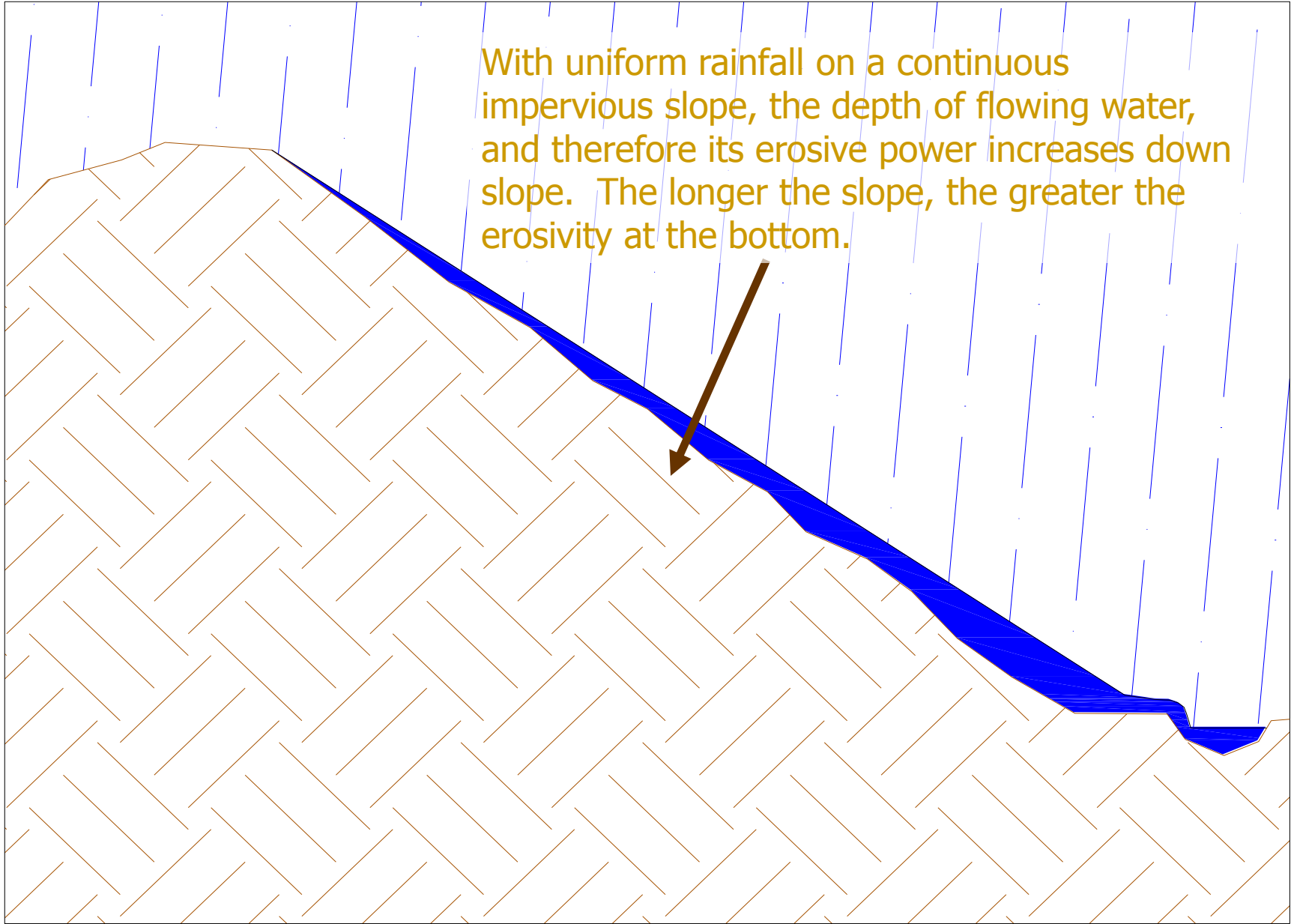
Slope Steepness

The ability of flowing water to carry sediment increases (roughly) with the cube of the slope angle!



Slope Length

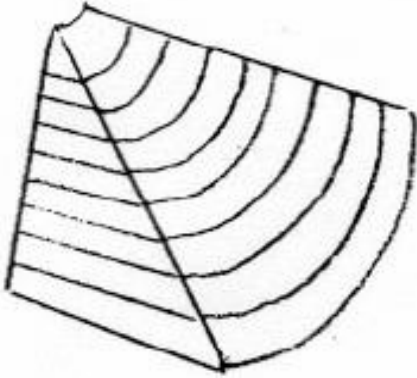
With uniform rainfall on a continuous impervious slope, the depth of flowing water, and therefore its erosive power increases down slope. The longer the slope, the greater the erosivity at the bottom.



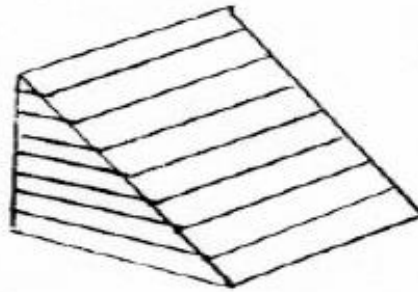
Slope curvature

1.] SLOPE CONFIGURATION

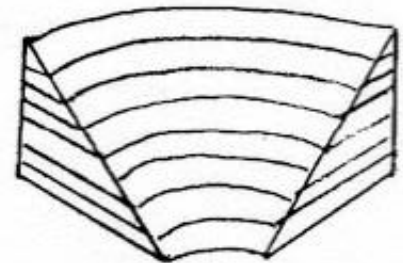
a.) Divergent (more stable)



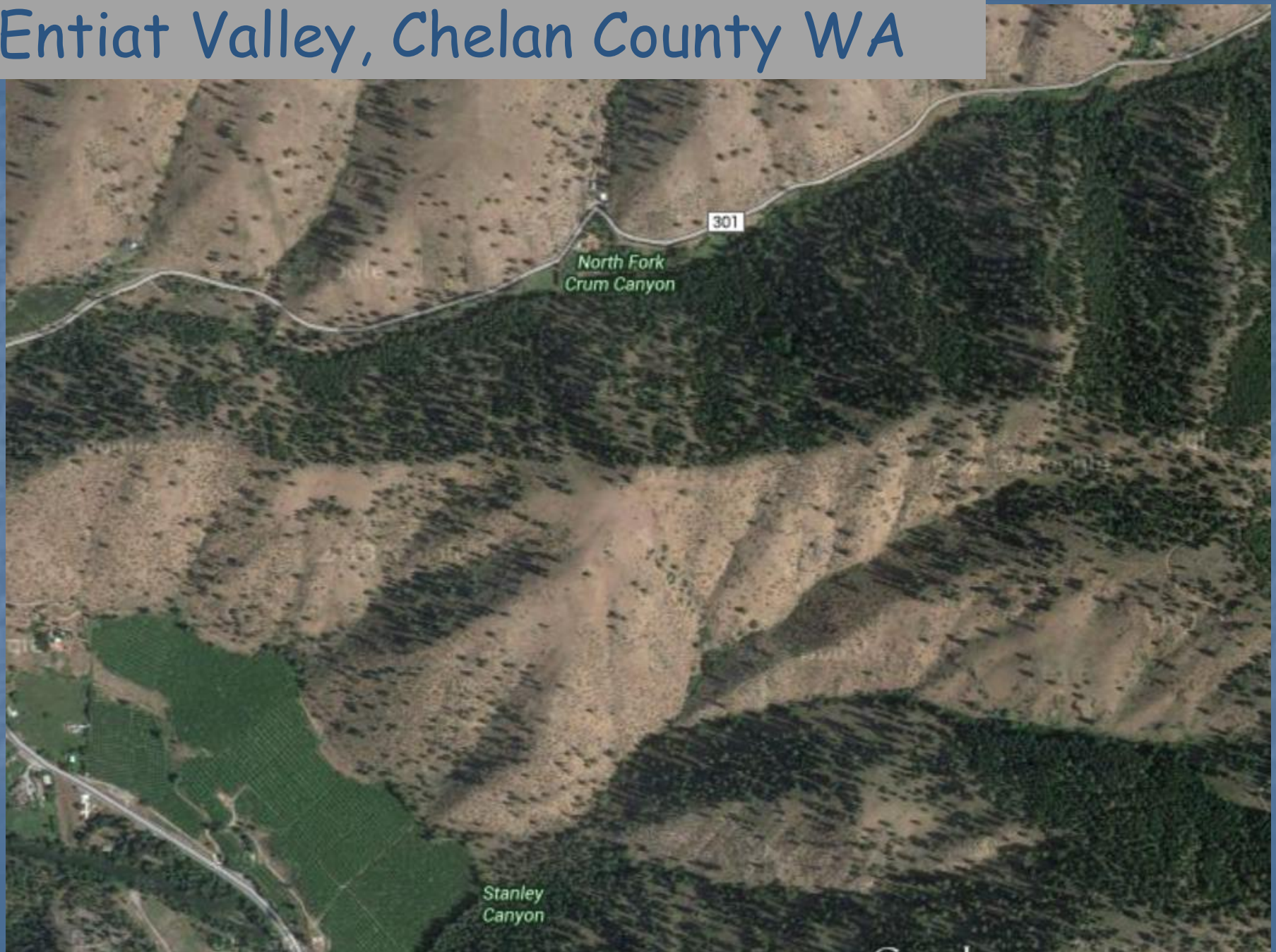
b.) Planar



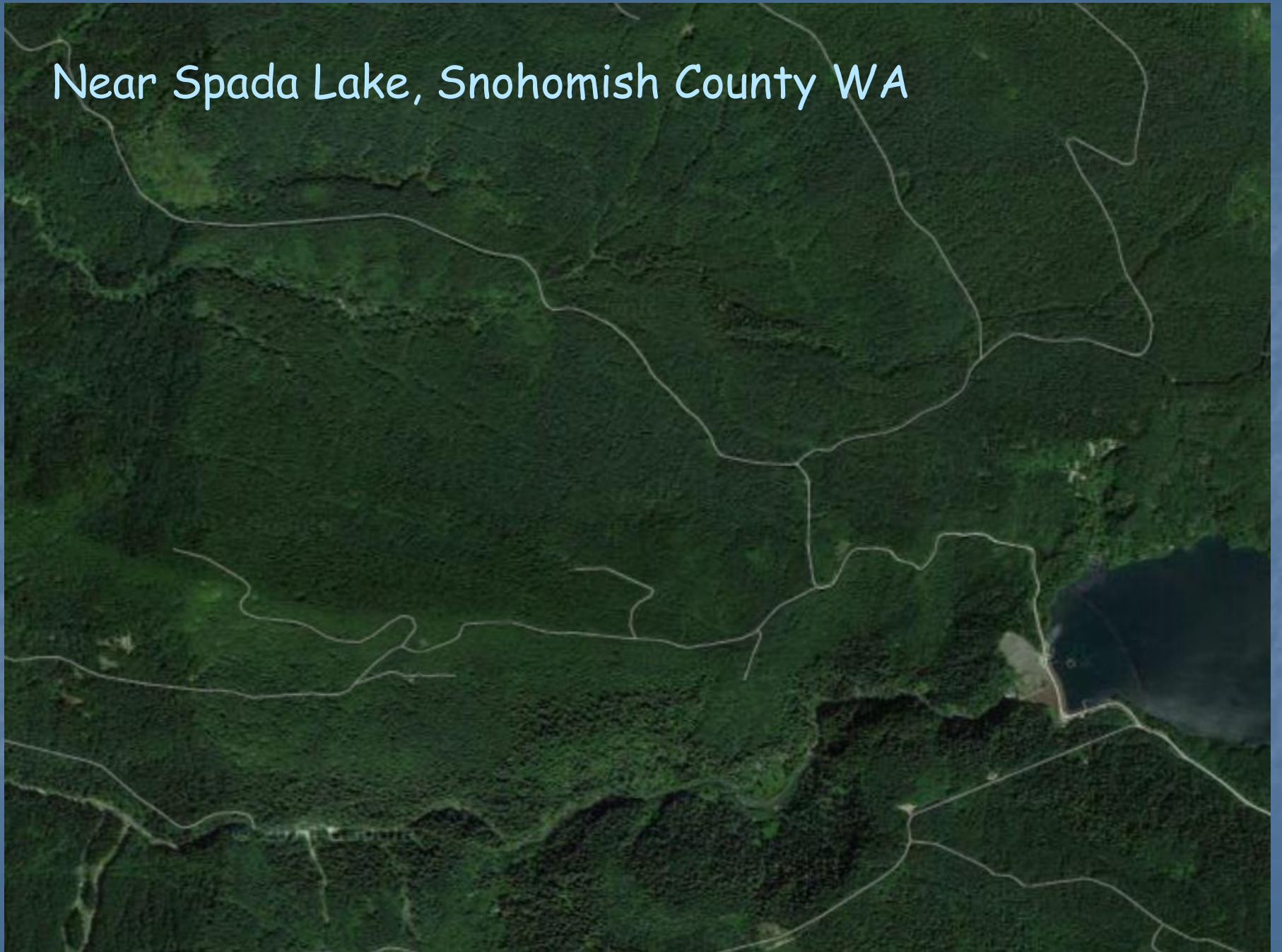
c.) Convergent (less stable)



Entiat Valley, Chelan County WA



Near Spada Lake, Snohomish County WA



Revised Universal Soil Loss Equation

$$A = R \times K \times LS \times C \times P$$

R= Rainfall Runoff Erosivity

K= Soil Erodibility

L= Length of Slope

S= Slope Steepness

C= Cover Practice

P= Support Practice

A= Soil Loss
in

Tons / Acre / Year

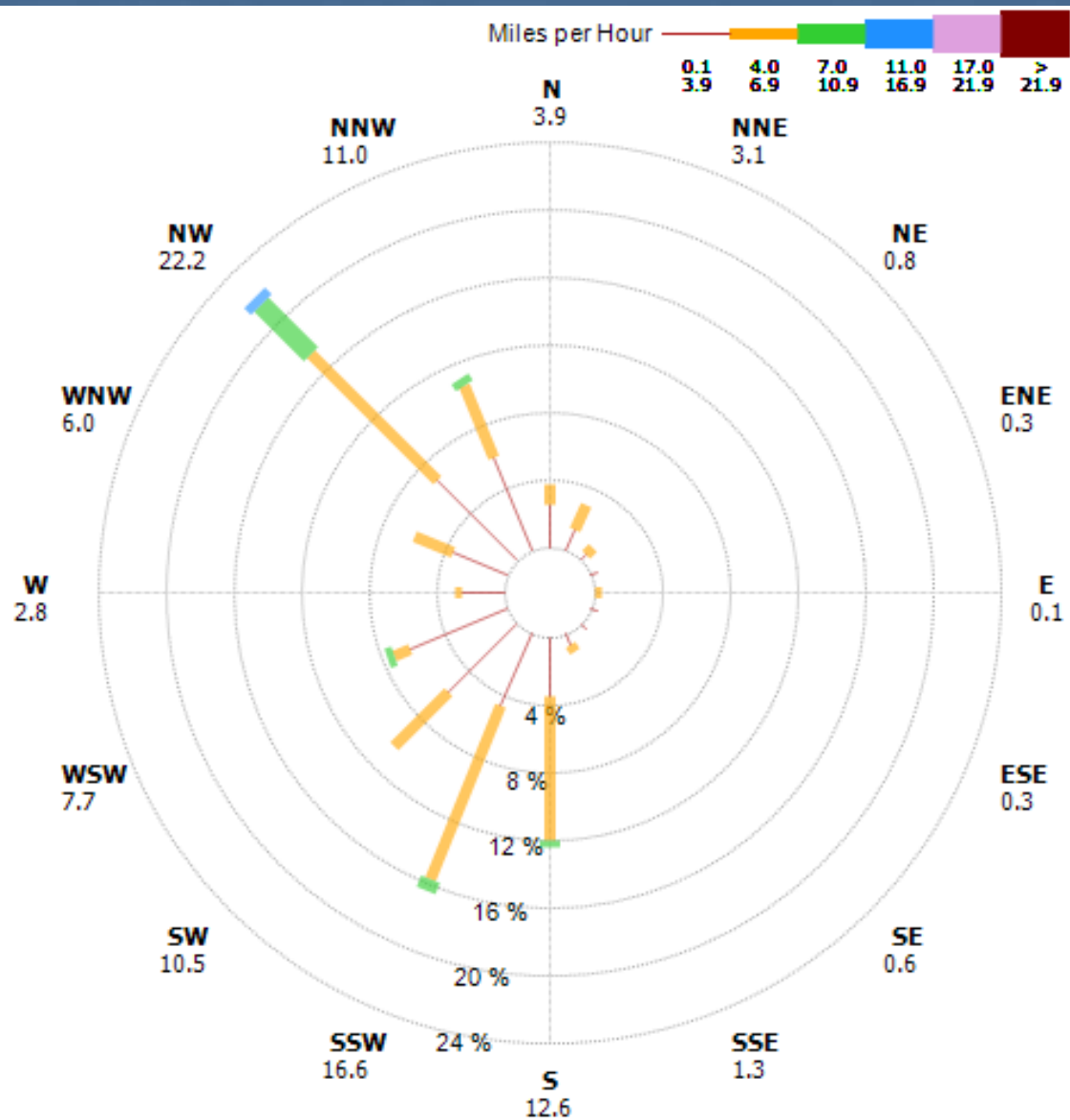
Wind Erosion



Factors Affecting Wind Erosion

Field conditions conducive to wind erosion are:

- Loose, dry, and finely granulated soil
- Smooth soil surface with little or no vegetation present
- Sufficiently large area susceptible to erosion
- Sufficient wind velocity to move soil. Winds are considered erosive when they reach 13 miles per hour at one (1) foot above the ground or about 18 miles per hour at 30 feet (threshold velocity).



Hour Average Wind Speed Propeller
Seattle Duwamish Vly ~ 1,440 Observations
01 Jul 2010 through 30 Jul 2010

As a rule of thumb, wind speeds greater than 8 m/s (17 mph) at 2 meters (6feet) height are generally required to initiate movement of mineral soils.





